

WESTERN PINE BEETLE



Background

The western pine beetle is an aggressive killer of ponderosa pine throughout Idaho and neighboring states. Trees are killed as the beetles bore through the bark to the surface of the wood where they chew out small tunnels as sites for laying eggs. Thousands of beetles will attack a single tree and the tunnels they construct girdle the tree, starving the roots. As they attack, the beetles carry spores of a blue-stain fungus into the tree with them. These spores rub off of the beetle, germinate and grow into the sap wood where the fungus tissue plugs up the water conducting vessels, starving the tree crown. The combined effects of the beetle and the fungus kill the tree.

The beetle devastated stands of large, over-mature, decadent pines in the first half of the twentieth century. Where stands of this nature still exist, there is great potential for damage. Even single, large, old, slow growing or stagnated trees are very susceptible to attack, especially those that have been struck by lightning.

Recently, this beetle has become especially aggressive in second growth stands, killing trees six inches or larger in diameter, including apparently healthy trees. Trees are characteristically killed in groups, primarily in dense, overstocked stands of pure, even-aged pines. Drought weakened trees are especially susceptible and outbreak populations can build to very high levels under these conditions.

Hosts

Ponderosa pine, (*Pinus ponderosa* Laws), also known as yellow pine or bull pine depending on its maturity, is the only host in Idaho.

Life Stages and Description

The life stages are similar to other bark beetles, having eggs, larvae, pupae and adults (Figure 1). The adult is dark brown to black and about 3-5 mm long. They have wings and are good flyers. Eggs, which are about the size of the head of a pin, are laid in niches cut along the sides of the gallery by the female beetle. After hatching, the larvae, or grubs, feed, tunneling outward, from the inner bark into the outer bark where pupation and transformation to the adult stage occurs. The larvae are creamy white with a brown head, legless, and when fully developed, about 5 mm long. They are often difficult to find because of their habit of boring into the bark. The pupa is also white, and has a form more like the adult insect except that the wings and wing covers are folded around the body while those of the adult cover the top of the abdomen. The newly formed adult is light brown, and is termed a "callow adult." It stays under the bark until fully mature.

Life History

Life cycles and numbers of generations per year vary in different parts of the beetle's range. In Idaho, there are usually two generations annually. The insect overwinters mainly as large larvae within the bark of trees attacked during the preceding spring or summer. New adults emerge and attack green

George B. Bacon
Director and State Forester
Idaho Department of Lands
300 N. 6th, Suite 103
Boise, ID 83720
Phone: (208) 334-0200

Insect and Disease
No. 7
February 2009

Craig Foss
Chief, Bureau of Forestry
Assistance
3780 Industrial Ave. S.
Coeur d'Alene, ID 83815
Phone: (208) 769-1525

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trees during May and June. Their progeny complete their development by July and August and the adult beetles emerge to attack additional trees throughout September, completing the yearly cycle. In warmer climates and at lower elevations there may be as many as three or four generations, with attacks as early as March and as late as November. In addition to having multiple generations, adults may make their initial attack, then reemerge and initiate another attack either in the same tree, or in an adjacent new one. Recent surveys have shown that adult beetles are flying all summer long.

Signs of Attack

Small, 1/4 to 3/4 inch, masses of reddish brown resin and boring dust, called pitch tubes (Figure 2), are sometimes formed at the site of the attack. They are usually the first evidence of an infestation. However, pitch tubes are not always formed, and many attacks occur without them.

The presence of a few often widely scattered white pitch tubes, 1 inch or larger in diameter, may indicate an unsuccessful attack. The success of the attack can be checked by using an ax or increment borer to determine the condition of the inner bark. If it is cream-colored and moist, the tree has a fair chance of surviving. If it is dark and dry, the tree is doomed, even though the needles of the crown may still be green.

Positive proof of successful attack by this beetle is determined by finding its galleries or tunnels underneath the bark. Here, egg galleries are tunneled out by the adult beetle, winding both horizontally and vertically, crisscrossing each other in a maze-like pattern (Figure 2, B). They also score the surface of the wood. The western pine beetle is the only bark beetle to make this gallery pattern in ponderosa pine.

Trees killed by this beetle fade in much the same manner as other beetle-killed pines, going through

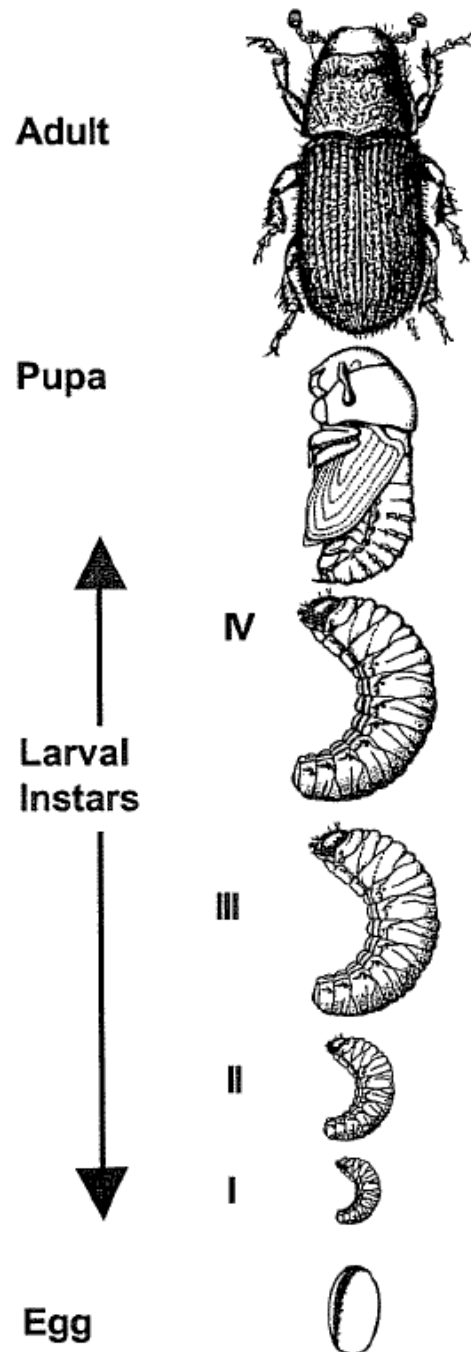


Figure 1. Bark beetle life cycle
Redrawn from figures provided by
Canadian Forestry Service

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a succession of colors from yellow to red. Trees attacked in September fade the following winter or spring. Those attacked during the summer may fade before the beetles emerge, depending on weather conditions.

Another indicator of beetle attack is the feeding activity of woodpeckers, which flake off the outer bark in their search for grubs. The trunks of trees that have been worked on by woodpeckers will show up bright red to orange, and are easily seen. The bark flakes often pile up on the ground around the base of the tree. These are especially evident in the winter when snow is present. Sometimes the needles on a tree worked on by woodpeckers may still be green when first observed, but the trees will not survive.

Management

DIRECT CONTROL: Direct control measures may be needed in areas of high timber values such as home sites, campgrounds, or recreational areas. Broods in infested trees can be killed by felling the tree and immediately burning, debarking, or spraying it with toxic chemicals. If the larvae are well developed, debarking by itself will not kill them. In these instances the bark would have to be burned or otherwise destroyed. If western pine beetle infested ponderosa pine is used for firewood, care needs to be taken to use the wood, at least the bark, before the adults can emerge in the spring or they may attack and kill nearby pines.

PREVENTIVE SPRAYS: Chemicals are available which will successfully protect trees from attack. They are applied to the bole of the tree prior to beetle flight. Carbaryl and permethrin applied as water-based sprays, are registered for this use. Beetles initially attack a standing tree about midway up the bole with subsequent attacks filling in above and below. Thus preventive sprays need to cover as much of the trunk as possible.

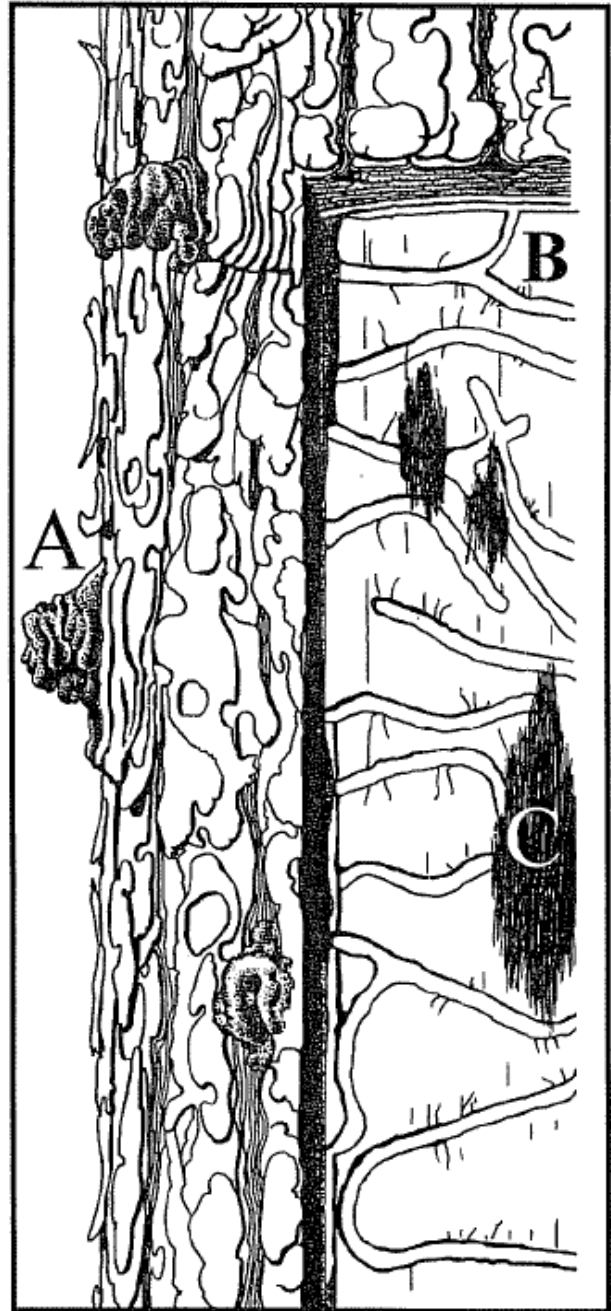


Figure 2. A. Pitch tube; B. Egg galleries;
C. Blue-stain fungus
Redrawn from figures provided by the
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SILVICULTURAL ALTERNATIVES: For **old-growth stands** of ponderosa pine the most effective means of reducing losses to the western pine beetle is by risk rating trees with subsequent removal of those that are high risk. This is done by using individual tree characteristics including age, crown size and form, vigor, and dominance. Large older trees with flat, poor, thin crowns and slow growth rates are most likely to be attacked and killed. Trees having these characteristics should be removed from the stands when the management objective is to maximize wood production.

In **second growth stands**, those factors that influence tree vigor are of the greatest importance in contributing to susceptibility of attack by the western pine beetle. Usually, stand density is the most important factor. Thus, thinning the trees will increase tree vigor and reduce the risk of beetle attack in those trees that remain. A general rule of thumb is to remove enough trees so that the tree crowns do not touch. Reducing the basal area to 80-100 square feet per acre is another guide that is very effective. With an average tree diameter of 10 inches, leaving 150-180 trees/acre will produce the desired condition (a 16'x 16' spacing will leave about 170 trees/acre). With 12-inch trees, leave 100-125 trees/acre (a 18'x 20' spacing will leave about 120 trees/acre).

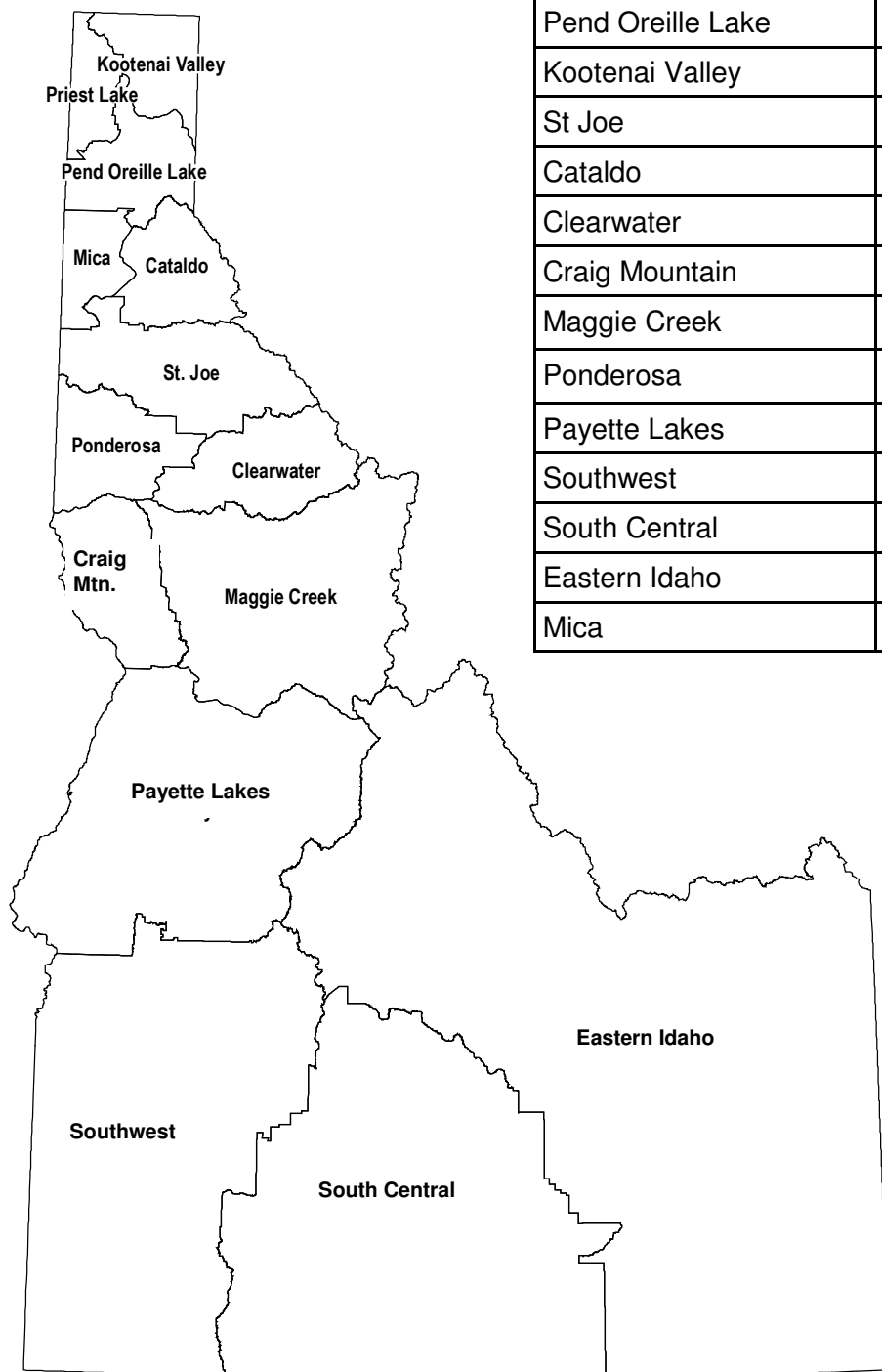
In both old-growth and second growth stands, trees weakened by defoliation, root disease, lightning, fire, mechanical injury, breakage, soil disturbances, or attacked by other bark beetles may be susceptible and should be removed as quickly as possible.

Rapid, vigorous tree growth increases host resistance and reduces the likelihood of outbreaks. This emphasizes the need for management practices which promote healthy trees.

NATURAL CONTROL: While woodpeckers and insect enemies of the western pine beetle do exert pressure on beetle populations, they seldom are able to stop an outbreak. Beetle abundance is most often determined by climatic conditions and host resistance. Winter temperatures of -40° F and lower for a week or more have been found to cause heavy mortality to overwintering broods. Conversely, drought, which stresses the trees, promotes beetle survival and the development of outbreaks.



**FOR MORE INFORMATION CONTACT
ANY IDAHO DEPARTMENT OF LANDS
PRIVATE FORESTRY SPECIALIST**



Area Office	Location	Phone
Priest Lake	Coolin	(208) 443-2516
Pend Oreille Lake	Sandpoint	(208) 263-5104
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